

Culvert Backfill and Excavation Quantities

This section discusses the determination of quantity of backfill adjacent to culverts and livestock passes, and quantity of excavation for culverts.

Backfill Adjacent to Box Culverts and Livestock Passes

The quantity of backfill placed and compacted by the grading contractor adjacent to box culverts and livestock passes is determined as described in Section 2107.16D in the Standard Specifications. The following formula is used:

$$Q = \frac{(4 \times L \times H)}{27} \text{ English}$$

$$Q = 1.2 \times L \times H \text{ metric}$$

Where

Q = quantity of compacted backfill in yd³ (m³)

L = (1) length in feet (meters) of the culvert or stock pass from back to back of parapet

or

(2) length in feet (meters) from back of the existing parapet to back of the parapet of the extension.

H = nominal height of the structure opening in feet (meters).

Backfill Adjacent to Pipe Culverts

For pipe culverts requiring moisture control, the quantity of compacted backfill placed should be calculated in the same manner as quantity of excavation for a pipe culvert, see below.

Excavation (Pipe Culverts)

The quantity of excavation measured shall be as described in Section 2402.12A of the Standard Specifications and shall be considered Class 20 excavation. The following formulas are used:

$$Q = \frac{(EA) \times \left(\frac{w}{12} + h \right)}{27 \times \cos(\theta)} \text{ English}$$

$$Q = \frac{(EA) \times (w + h)}{\cos(\theta)} \text{ metric}$$

Where

Q = quantity of excavation in yd³ (m³)

EA = cross sectional end area in ft² (m²) at a right angle to the centerline of the roadway or along the centerline of a culvert

w = width at bottom of trench in inches (meters), see Figures 1, 4, and 5

h = height at centerline of a culvert from the bottom of the culvert to natural ground line or grading template, whichever is closest to the bottom of the culvert, in feet (meters)

L = length of trench in feet (meters)

θ = Skew angle (in degrees)

Determining w

Figure 1 below demonstrates how to determine w for a pipe culvert according to Section 2402.12A of the Standard Specifications.

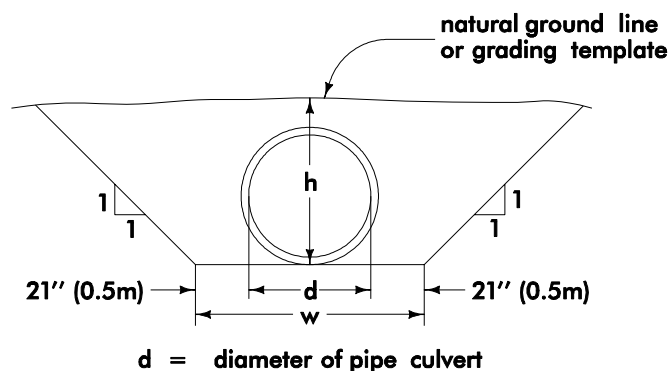


Figure 1: Determining w for Pipe Culvert.

Determining End Area (EA)

End area (EA) is normally determined along the centerline of the culvert (Figure 2), but may be determined at a right angle to the roadway (Figure 3). If EA is determined along the centerline of the culvert, then it is not necessary to include the skew angle when calculating Q.

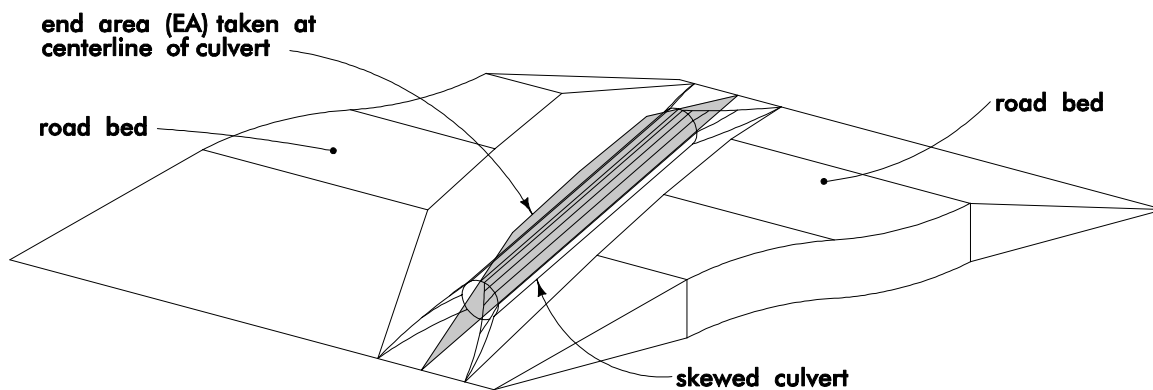


Figure 2: EA taken at centerline of culvert. Skew not included when calculating Q.

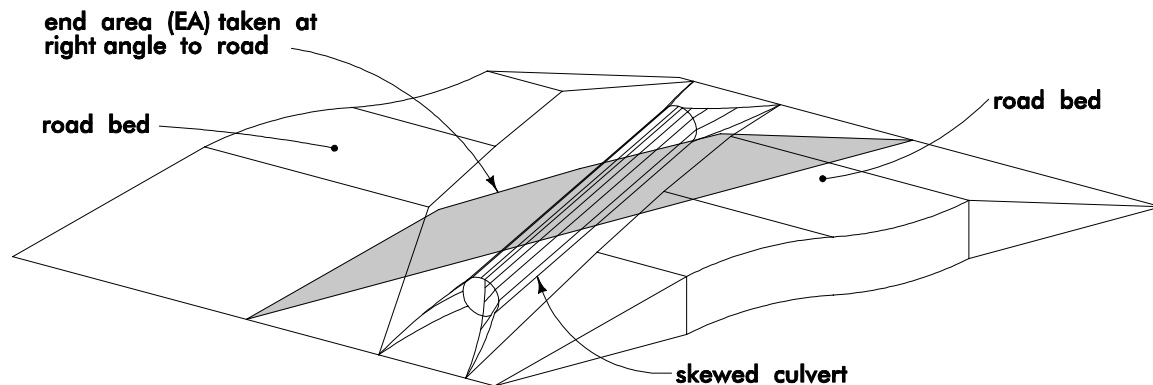


Figure 3: EA taken at right angle to roadway. Skew angle must be included when calculating Q.

Excavation (RCB Culverts)

The Road Contractor determines excavation for RCB culverts. Figures 4 and 5 below demonstrate how w should be determined based on moisture control requirements.

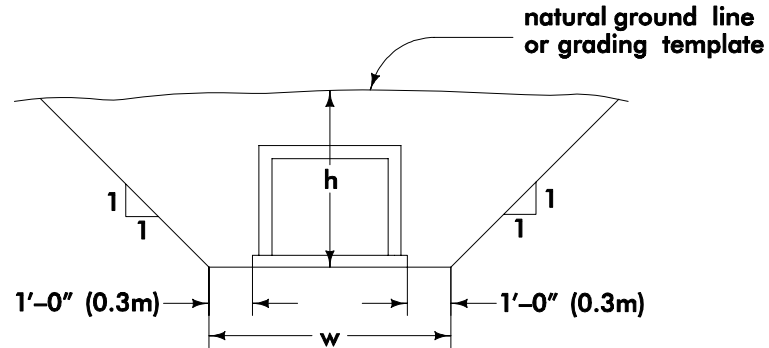


Figure 4: Determining w for RCB Culvert; No Moisture Control.

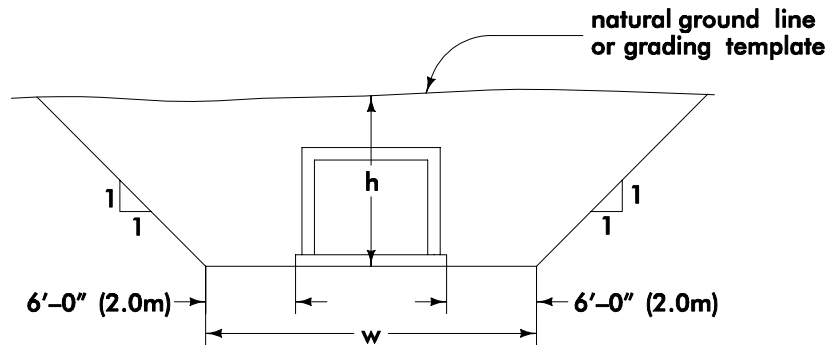


Figure 5: Determining w for RCB Culvert; Moisture Control Required.